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**Contact:** Pierpaolo Palumbo, Inês Sousa      Email: [pierpaolo.palumbo@unibo.it](mailto:pierpaolo.palumbo@unibo.it),  
University of Bologna, Italy;                      [ines.sousa@fraunhofer.pt](mailto:ines.sousa@fraunhofer.pt)  
Fraunhofer Portugal

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**Abstract:** Calling on members of the medical and artificial intelligence communities with a vested interest in AI to prevent falls among the elderly! Become engaged in the group dedicated to establishing a standardized benchmarking platform for AI to prevent falls among the elderly within the International Telecommunication Union (ITU)/World Health Organization (WHO) Focus Group on “Artificial Intelligence for Health” (FG-AI4H).

This version of the CfTGP is the same as seen in Meeting H (FGAI4H-H-012-A02), reproduced for easier reference as a Meeting N document.

Pierpaolo Palumbo (University of Bologna, Italy) is interim driver until Sept 2021, taking over for Inês Sousa (Fraunhofer Portugal).

### **Call for Topic Group Participation: AI to prevent falls among the elderly**

The International Telecommunication Union (ITU)/World Health Organization (WHO) Focus Group on “Artificial Intelligence for Health” (FG-AI4H; <https://www.itu.int/go/fgai4h>) seeks engagement from members of the medical and artificial intelligence (AI) communities (including clinicians, technologists, entrepreneurs, potential benchmarking data providers, machine learning experts, software developers, researchers, regulators, policy-makers, companies/institutions, and field experts) with a vested interest in shaping the benchmarking process of AI to prevent falls among the elderly.

#### **1 About FG-AI4H**

Over the past decade, considerable resources have been allocated to exploring the use of AI for health, which has revealed an immense potential. Yet, due to the complexity of AI models, it is difficult to understand their strengths, weaknesses, and limitations. If the technology is poorly designed or the underlying training data are biased or incomplete, errors or problematic results can occur. AI technology can only be used with complete confidence if it has been quality controlled through a rigorous evaluation in a standardized way. Towards developing this standard assessment framework of AI for health, the ITU has established FG-AI4H in partnership with the WHO.

Thus far, FG-AI4H has established 12 topic groups. These are concerned with: AI and cardiovascular disease risk prediction, dermatology, falls among the elderly, histopathology, neurological disorders, outbreak detection, ophthalmology (retinal imaging diagnostics), psychiatry, snakebite and snake identification, symptom assessment, tuberculosis, and volumetric chest

computed tomography. Six other groups are starting their activities: diagnoses of bacterial infection and anti-microbial resistance, dental diagnostics and digital dentistry, AI-based detection of falsified medicine, malaria detection, maternal and child health, and radiotherapy.

Each topic group agrees upon representative benchmarking tasks in a pragmatic, best-practice approach, which can later be scaled and expanded to similar tasks. Every benchmarking task should address a health problem of relevance (e.g. impacting a large and diverse part of the global population or challenging to treat) and for which AI technology would provide a tangible improvement relative to the current practice (e.g. better care, results, and/or cost/time effectiveness).

For a rigorous and sound evaluation, undisclosed test data sets must be available (or have to be collected) for each task. All data must be of high quality and compliant with ethical and legal standards. In addition, the data must originate from a variety of sources so that it can be determined whether an AI algorithm can generalize across different conditions, locations, or settings (e.g. across different people, hospitals, and/or measurement devices). The format/properties of the data serving as input to the AI and of the output expected from the AI, as well as the benchmarking metrics are agreed upon and specified by the topic group.

Finally, the AI-to-be-evaluated will be benchmarked with the undisclosed test data on FG-AI4H computing infrastructure. Here, the AI will process single samples of the undisclosed test data set and predict output variables, which will be compared with the "ground truth." The results of the benchmarking will be provided to the AI developers and will appear on a (potentially anonymized) leaderboard.

## **2 Topic group: AI to prevent falls among the elderly**

A topic group is a community of stakeholders from the medical and AI communities with a shared interest in a topic. The objectives of the topic groups are manifold:

1. to provide a forum for open communication among various stakeholders,
2. to agree upon the benchmarking tasks of this topic and scoring metrics,
3. to facilitate the collection of high quality labeled test data from different sources,
4. to clarify the input and output format of the test data,
5. to define and set-up the technical benchmarking infrastructure, and
6. to coordinate the benchmarking process in collaboration with the Focus Group management and working groups.

The primary output of a topic group is one document that describes all aspects of how to perform the benchmarking for this topic. (The document will be developed in a cooperative way by suggesting changes as input documents for the next FG-AI4H meeting that will then be discussed and integrated into an official output document of this meeting. The process will continue over several meetings until the topic description document is ready for performing the first benchmarking.)

This topic group is dedicated to AI to prevent falls among the elderly. Falls are one of the most common health problems in the elderly population, about a third of community-dwelling adults aged 65 years or older fall each year, and these events represent more than 50% of the hospitalizations due to lesions in this age group. Falls are also considered one of the main causes for loss of independence and institutionalization. In 10% of cases falls result in fractures, thus contributing to significant increases in morbidity and mortality. Direct health care costs associated with this phenomenon are high, reaching yearly costs of 25 billion euros in the European Union and 31 billion dollars in the United States of America. Falls have a multifactorial origin, however most of the fall risk factors are amendable by implementing falls prevention programs based on improving strength and balance and modifying behaviours. Even though, fall risk screenings and

the implementation of such falls prevention programs are rarely part of the community-dwelling elder's routine.

The current state of the art assessment of fall risk factors is based mainly in applying clinical scales, such as the Morse Fall Scale, Berg Balance Scale, and Performance Oriented Assessment of Mobility Problems in Elderly Patients. Despite being recommended by international health bodies, such as the National Institute for Health and Care excellence (NICE)<sup>1</sup>, risk screening is still not widespread in the clinical practice. One of the reasons for this shortcoming is the difficulty in combining the multiple parameters evaluated in a meaningful scale that is able to differentiate those who are more likely to fall in a period of time following the assessment. Artificial Intelligence (AI) techniques can be of great value in generating models that combine multiple sources of data and enable the implementation and standardization of a multifactorial assessment of the risk of falling. This would enable to raise awareness for multifactorial assessment of fall risk factors, contribute to standardize fall risk assessment and create tools to easily implement it in the clinical practice.

Among much previous work done on this topic, here we mention the project FallSensing [www.fallsensing.com](http://www.fallsensing.com), conducted by Fraunhofer AICOS, Coimbra Health School, and Sensing Future Technologies. They have collected a dataset of 537 test subjects, to whom a multifactorial assessment of fall risk factors was applied following a specific [protocol](#). The screening includes questions about demographic and anthropometric data, health and lifestyle behaviours, a detailed explanation about procedures to accomplish 6 functional tests (grip strength, Timed Up and Go, 30 seconds sit to stand, step test, 4-Stage Balance test “modified,” and 10-meter walking speed), 3 questionnaires concerning environmental home hazards, and an activity and participation profile related to mobility and self-efficacy for exercise. After the assessment, 403 participants received monthly phone calls over a 12-month period to record the occurrence of falls. The dataset is thus annotated with the number and month of reported falls in the period of 12 months following the assessment. This annotation can be converted in a binary outcome, dividing the dataset in fallers (subjects who fell at least once in the 12-month follow-up period), and non-fallers (remaining).

Regarding data availability, the FallSensing dataset is made of 403 annotated data samples. All of the data is currently an undisclosed data set. Only a small part of it can be made publicly available (1 or 2%) for model training while the rest can be used for model evaluation. However, since the data acquisition protocol is published in an open access journal, it can be easily replicated by peers.

For the benchmarking task, participants should submit AI models to combine multiple fall risk factors assessed in community-dwelling adults aged over 65 years old. The expected semantics of the predictions and the evaluation criteria are still to be determined. Regarding the semantics of the predictions, the models should distinguish fallers from non-fallers, i.e. the subjects that suffered at least one fall in the year subsequent to the assessment from those who did not fall in that period. Other possible outcomes are the predicted time until the first fall (in months), or the probability of suffering a fall in a given period during the year after the assessment. The problem can also be formulated as multiclass classification, allowing to distinguish groups of first-time fallers after the assessment, recurrent fallers and non-fallers, for example. As possible performance metrics, we are currently considering metrics related to the calibration and the discriminative ability of the models (e.g. sensitivity, specificity, and area under the receiver operating characteristic curve (ROC AUC) applied to a binary classification problem).

More details about the activities of the topic group can be found in the documents [FGAI4H-C-014](#). These can be accessed with a free ITU account (cf. “Get involved”).

Current members of the topic group on AI to prevent falls among the elderly include Inês Sousa, PhD in Biomedical Engineering, and Head of Intelligent Systems at Fraunhofer AICOS and Pierpaolo Palumbo, PhD in Bioengineering and postdoctoral fellow at the University of Bologna.

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<sup>1</sup> <https://www.nice.org.uk/guidance/cg161/chapter/recommendations#multifactorial-assessment-or-multifactorial-falls-risk-assessment>

The topic group would benefit from further expertise of the medical and AI communities and from additional data.

### 3 Get involved

To participate in the topic group on AI to prevent falls among the elderly, please complete the document template found at : <https://www.itu.int/en/ITU-T/focusgroups/ai4h/Documents/FG-AI4H-Doc-template.docx>. **First**, update the document header as follows. WG(s): *N/A - place, date*.

Source: *Your name*. Title: *Participation in the topic group on AI to prevent falls among the elderly*. Purpose: *Discussion*. Contact: *Insert contact name, contact organization, country, telephone, e-mail*. Abstract: *Short summary of main text*.

In the main text, introduce yourself/your organization, explain your interest in the topic group on AI to prevent falls among the elderly, describe your relevant experience and expertise, and indicate the potential availability of undisclosed test data. This document will be published on the FG-AI4H collaboration site. Meeting attendance is expected. Please email the completed document template to [tsbfgai4h@itu.int](mailto:tsbfgai4h@itu.int).

Participation in FG-AI4H is free of charge and open to all. To attend the workshops and meetings (upcoming events are 22-24 January 2020 in Brasilia, Brazil; 16-20 March in Singapore, 4-8 May in Geneva), please create a free ITU account by registering on the Focus Group website (<https://www.itu.int/go/fgai4h>). On this website, you can also find the whitepaper and key output documents, and sign up to the mailing list.

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